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National Voluntary Laboratory Accreditation Program

Energy Efficient Lighting Products

Lawrence S. Galowin
Wiley Hall
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NIST HANDBOOK 150-1

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[2] Some elements at Boulder, CO 80303.

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July 1994

U.S. Department of Commerce
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PREFACE

NIST Handbook 150-1 presents the technical requirements of the National Voluntary Laboratory Accreditation Program (NVLAP) for the Energy Efficient Lighting (EEL) Products field of accreditation. It is intended for information and use by staff of accredited laboratories, those laboratories seeking accreditation, other laboratory accreditation systems, users of laboratory services, and others needing information on the requirements for accreditation under the EEL program.

This publication supplements NIST Handbook 150, *NVLAP Procedures and General Requirements*, which contains Part 285 of Title 15 of the U.S. Code of Federal Regulations (CFR) plus all general NVLAP procedures, criteria, and policies. The criteria in NIST Handbook 150 encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987). Handbook 150-1 contains information that is specific to the EEL program and does not duplicate information contained in the Procedures and General Requirements. The numbering of the sections of this handbook is patterned after Handbook 150; for example, Section 285.3 of Handbook 150 presents the description and goal of NVLAP, whereas Section 285.3 of Handbook 150-1 presents the description of the EEL program. Where there is no material specific to the field of accreditation, the section number is omitted.

Any questions or comments on this handbook should be submitted to the National Institute of Standards and Technology/NVLAP, Building 411, Room A162, Gaithersburg, MD 20899; phone (301) 975-4016; FAX (301) 926-2884.

ACKNOWLEDGMENTS

The technical requirements for the Energy Efficient Lighting Products Program described in this handbook were developed in cooperation with the Lighting Equipment Division of the National Electrical Manufacturers Association (NEMA). Two task groups were initiated by NEMA to work with NVLAP staff: one on lamps and the other on luminaires. The handbook authors acknowledge with thanks the contributions of the NEMA task group members in suggesting and reviewing the technical requirements, including critical element summaries proposed for the program. The assistance of Joseph Murdoch, University of New Hampshire, in preparing the critical element summaries is also acknowledged. The contributions of the NEMA task groups were coordinated through Ronald Runkles, NEMA, whose efforts the authors sincerely appreciate.

The authors also express thanks and appreciation to their NIST colleagues for their contributions to the development of the program. Albert Tholen provided guidance and direction. Stephen Treado spent considerable time discussing the program and offering suggestions for the technical requirements. Albert Tholen, Stephen Treado, and Patrick Cooke provided thorough reviews of the handbook. Sherrie Abrecht assisted with typing and printing. Thanks are also extended to Terry Logee, DOE, for his review and comments on the handbook.

Special thanks are extended to Vanda White, NVLAP, who edited and revised the many draft versions of the handbook as well as arranging for its final publication. She also provided outstanding administrative support in the development of the program. Her dedicated assistance and cheerful responsiveness to the authors' many requests to have revised drafts, as well as other documents, completed within tight deadlines are greatly appreciated.

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SUMMARY

Any laboratory (including commercial, manufacturer, university, or federal, state, or local government laboratory) that performs the test method that comprises the EEL Program may apply for NVLAP accreditation. Accreditation will be granted to a laboratory that satisfactorily fulfills the conditions for accreditation defined in the NVLAP Procedures: Title 15, Part 285 of the Code of Federal Regulations (see NIST Handbook 150). These conditions include satisfactory performance in selected proficiency testing as required, and fulfilling the on-site assessment requirements, including resolution of identified deficiencies. The names of NVLAP-accredited laboratories are published in the NVLAP annual directory and other media to which information is regularly provided.

Test methods covered: The scope of the EEL Program covers standard methods for lamps and luminaires given in the Test Method Selection List (Appendix D). The test method list is consistent with the requirements of the Energy Policy Act of 1992 (EPACT; Public Law 102-486, October 24, 1992).

In the case of lamps, the methods encompass the measurement of electrical, photometric, colorimetric, and life-performance characteristics. For luminaires, the methods cover photometric measurements.

Period of accreditation: One year, renewable annually.

On-site assessment: Visit by a technical expert to determine compliance with the NVLAP criteria before initial accreditation and every 2 years thereafter. Additional monitoring visits as required.

Assessors: Technical experts with experience in lamp and luminaire testing.

Proficiency Testing: Each laboratory is required to test and analyze proficiency testing sample material(s) for specific test methods. Proficiency testing is conducted semiannually. Advance notice and instructions are given before testing is scheduled. The completed test data report is sent to NVLAP or, as directed, to the proficiency testing contractor. A summary of results is sent to the participants.

Granting Accreditation: Based upon satisfactory on-site assessment and resolution of deficiencies, proficiency testing, and technical evaluation of applicable laboratory information.

Fees: Payments are required as listed on the fee schedule, including the administrative/technical support fee, on-site assessment fee, proficiency testing fee, and test method fee.

Sec. 285.1 Purpose

The purpose of this handbook is to set out procedures and technical requirements for NVLAP accreditation of laboratories which perform test methods covered by the Energy Efficient Lighting (EEL) Products program. It complements and supplements the NVLAP programmatic procedures and general requirements found in NIST Handbook 150. The interpretive comments and additional requirements contained in this handbook make the general NVLAP criteria specifically applicable to the EEL program.

Sec. 285.2 Organization of procedures

(a) The procedures described in this handbook are organized to cross-reference with NIST Handbook 150, *NVLAP Procedures and General Requirements*.

(b) In addition, the handbook contains seven appendices:

(1) Appendix A provides examples of a Scope of Accreditation and a Certificate of Accreditation for the EEL program;

(2) Appendix B provides the General Operations Checklist, which NVLAP assessors use during an on-site technical assessment to evaluate a laboratory's ability to conduct testing in general;

(3) Appendix C provides the Specific Operations Checklist, which NVLAP assessors use during an on-site technical assessment of a laboratory that tests the electrical, photometric, colorimetric, and life-performance characteristics of lamps and luminaires;

(4) Appendix D lists the standard test methods and their accompanying NVLAP Codes for the EEL program as given on the NVLAP Test Method Selection List;

(5) Appendix E gives a description of a critical element summary as used by NVLAP assessors during an on-site technical assessment;

(6) Appendix F provides the sheets that the assessor completes in conducting a review of the test methods;

(7) Appendix G shows the On-Site Assessment Report cover sheet that is signed by the assessor and laboratory representative at the conclusion of the exit briefing.

Sec. 285.3 Description of Energy Efficient Lighting (EEL) Products program

The NVLAP Program for Energy Efficient Lighting (EEL) Products provides for laboratory accreditation as follows:

(a) Testing the Electrical, Photometric, Colorimetric, and Life-Performance Characteristics of Incandescent, Fluorescent and High Intensity Discharge Lamps; and

(b) Testing the Photometric Characteristics of Luminaires (Lighting Fixtures).

The scope of the EEL program covers the Illuminating Engineering Society (IES) and American National Standards Institute (ANSI) test methods listed in the Test Method Selection List (Appendix D).

Public Law 102-486, "Energy Policy Act of 1992," (October 24, 1992) requires that the Department of Energy (DOE) specify energy efficiency standards for certain types of fluorescent and incandescent reflector lamps. It also stipulates that DOE determine whether efficiency standards would be appropriate for other incandescent and general service fluorescent lamps. The test procedures for determining energy efficiency are to be prescribed by DOE, and are to be conducted by accredited laboratories using applicable Illuminating Engineering Society (IES) or American National Standards Institute (ANSI) standards.

In the case of luminaires, Public Law 102-486 does not require that DOE set mandatory energy efficiency standards. Rather, it mandates that DOE assist industry in developing a voluntary national program that would inform consumers of the energy savings to be achieved in selecting certain types of luminaires. Elements of the voluntary program include the selection of the types of luminaires, the specifying of test procedures and the development of a consumer information system. In this case, DOE would be required to monitor the voluntary program and determine whether it is sufficient to meet the objectives of the Energy Policy Act of 1992.

In anticipation of the passage of the Energy Policy Act of 1992, on November 27, 1990, the Lighting Equipment Division of the National Electrical Manufacturers Association (NEMA) requested that

the National Institute of Standards and Technology's National Voluntary Laboratory Accreditation Program (NVLAP) establish an accreditation program for laboratories that test certain types of lamps and luminaires. The purpose of the program was to accredit testing laboratories to assure that standard test methods for product performance (excluding safety) are followed in testing electric lighting products.

In response to the NEMA request and in accordance with NVLAP procedures, a notification of intent to establish the program was published in the *Federal Register* on January 25, 1991. The announcement of the development of the program appeared in the *Federal Register* on May 15, 1991. The test methods for lamps and luminaires covered by the program that is described in this handbook are consistent with the requirements of the Energy Policy Act of 1992. DOE was well-informed of the program development and requirements.

Sec. 285.4 References

(a) The following documents are referenced or cited in this handbook:

(1) ANSI standards:

(i) ANSI C78.375, *American National Standard for Fluorescent Lamps: Guide for Electrical Measurements*;

(ii) ANSI C78.386, *American National Standard for Electric Lamps: Mercury Lamps—Methods of Measuring Characteristics*;

(iii) ANSI C78.387, *American National Standard for Electric Lamps: Metal-Halide Lamps—Methods of Measuring Characteristics*; and

(iv) ANSI C78.388, *American National Standard for Electric Lamps: High-Pressure Sodium Lamps—Methods of Measuring Characteristics*;

(2) CIE Publication No. 13.2, *Method of Measuring and Specifying Color Rendering of Light Sources;*

(3) IES standards:

(i) IES LM-9, *IES Approved Method for the Electrical and Photometric Measurements of Fluorescent Lamps*;

(ii) IES LM-10, *IES Approved Method for Photometric Testing of Outdoor Fluorescent Lamps*;

(iii) IES LM-16, *Practical Guide to Colorimetry of Light Sources*;

(iv) IES LM-20, *IES Approved Method for Photometric Measuring and Reporting Tests on Reflector Type Lamps*;

(v) IES LM-31, *IES Approved Method for Photometric Testing of Roadway Luminaires Using Incandescent and HID Lamps*;

(vi) IES LM-35, *IES Approved Method for Photometric Testing of Floodlamps Using Incandescent Filament or Discharge Lamps*;

(vii) IES LM-40, *IES Approved Method for Life Performance Testing of Fluorescent Lamps*;

(viii) IES LM-41, *IES Approved Method for Life Performance Testing of Fluorescent Lamps*;

(ix) IES LM-45, *IES Approved Method for Electrical and Photometric Measurements of General Service Incandescent Lamps*;

(x) IES LM-46, *IES Approved Method for Photometric Testing of Indoor Luminaires High Intensity Discharge Lamps or Incandescent Filament Lamps*;

(xi) IES LM-47, *IES Approved Method for Life Testing of High Intensity Discharge (HID) Lamps*;

(xii) IES LM-49, *IES Approved Method for Life Testing of General Lighting Incandescent Filament Lamps*;

(xiii) IES LM-51, *IES Approved Method for the Electrical and Photometric Measurements of High Intensity Discharge Lamps*;

(xiv) IES LM-58, *IES Guide to Spectroradiometric Measurements*;

(xv) IES LM-65, *IES Approved Method for Life Testing of Single-Ended Compact Fluorescent Lamps*; and

(xvi) IES LM-66, *IES Approved Method for the Electrical and Photometric Measurements of Single-Ended Compact Fluorescent Lamps*;

(4) ISO/IEC Guide 25, *General Requirements for the Competence of Calibration and Testing Laboratories*;

(5) ISO 9002, *Quality Systems—Model for Quality Assurance in Production and Installation*;

(6) NCSL (National Conference of Standards Laboratories) Recommended Practice #7; *Laboratory Design*; July 25, 1993; and

(7) NIST Handbook 150, *NVLAP Procedures and General Requirements*.

(b) Sources for the above-referenced documents follow:

(1) ANSI standards, ISO/IEC Guide 25, and ISO 9002 may be ordered from:

American National Standards Institute
11 West 42 Street, 13th Floor
New York, NY 10036

Order Phone: (212) 642-4900
Order Fax: (212) 302-1286

(2) CIE Publication No. 13.2 may be ordered from:

U.S. National Committee/CIE
c/o TLA Lighting Consultants, Inc.
7 Pond Street
Salem, MA 01970-4819

Phone: (508) 745-6870
Order Fax: (508) 741-4420

(3) IES standards may be ordered from:

Illuminating Engineering Society of North America
345 East 47th Street
New York, NY 10017

Order Phone: (212) 248-5000
Order Fax: (212) 248-5017

(4) NCSL Recommended Practice #7 may be ordered from:

NCSL
1800 30th Street, Suite 305B
Boulder, CO 80301

Phone: (303) 440-3339
FAX: (303) 440-3384

(5) NIST Handbook 150 may be obtained from:

NIST/NVLAP
Building 411, Room A162
Gaithersburg, MD 20899

Phone: (301) 975-4016
Fax: (301) 926-2884.

Sec. 285.5 Definitions

Color rendering index (CRI): Measure of the degree of color shift objects undergo when illuminated by the light source as compared with the color of those same objects when illuminated by a reference source of comparable color temperature. (*IES Lighting Handbook*, Illuminating Engineering Society of North America, 1981.)

Critical element: A compilation of summary statements of the key provisions of a standard test method that guides individual assessors in applying a common objective assessment of a laboratory's ability to conduct tests.

Lamp: A generic term for a man-made source of light. (*IES Lighting Handbook*.)

Luminaire: A complete lighting unit consisting of a lamp of lamps together with the parts designed to distribute the light, to position and protect the lamps, and to connect the lamps to the power supply. (*IES Lighting Handbook*.)

Sec. 285.6 NVLAP documentation

(a) Test Method Selection List

Depending on the breadth of its testing capabilities, a laboratory may seek accreditation to all or only selected methods within the scope of the program. The Test Method Selection List, provided to the laboratory seeking accreditation as part of the NVLAP application package, lists the methods that comprise the program.

Appendix D shows the Test Method Selection List for the EEL program. The test methods listed apply to either lamps or luminaires. The lamp methods are further subdivided into electrical, photometric, color and life tests. Other test methods may be added to the EEL program upon request, following NVLAP procedures for adding to or modifying an established LAP (see Handbook 150, Sec. 285.18).

(b) Checklists

Checklists contain definitive statements or questions about all aspects of the NVLAP criteria for accreditation. NVLAP programs incorporate two types of checklists:

(1) The NVLAP General Operations Checklist addresses factors applicable to evaluating a laboratory's ability to conduct testing in accordance with the procedures and general requirements for accreditation. The factors include, but are not limited to, the laboratory's organization, management, and quality system in addition to its testing competency.

The General Operations Checklist, presented in Appendix B, is numbered to correspond to the requirements in NIST Handbook 150. The comment sheets are used by the assessor to explain findings and deficiencies noted on the checklist, as well as to make comments on aspects of the laboratory's performance other than deficiencies.

(2) The Specific Operations Checklist contains statements or questions that are specific to the test methods in the EEL program and focus on the testing requirements for the methods with emphasis on performing the tests, testing accuracy, instrumentation, calibration, personnel competency, and test reporting.

The Specific Operations Checklist is presented in Appendix C, along with comment sheets similar to those used with the General Operations Checklist.

Sec. 285.22 Assessing and evaluating a laboratory

(a) On-Site Assessment

(1) The NVLAP assessor may request manuals and/or documented procedures in advance of the on-site assessment to reduce time at the laboratory. Documents supplied in advance will be returned. The laboratory should be prepared for conducting test demonstrations, have equipment in good working order, and be ready for examination according to the requirements identified in this handbook, NIST Handbook 150, the laboratory's quality manual, and its written test procedures. The assessor will need time and work space to complete assessment documentation during the time at the laboratory.

(2) NVLAP technical assessors are provided with "critical elements" in addition to the checklists described in 285.6, *NVLAP documentation,* to help assure the completeness, objectivity, and uniformity of the on-site assessment. The format of a critical element is presented in Appendix E.

(3) Along with the Specific Operations Checklist, the assessor uses the instructions and comment sheets shown in Appendix F in reviewing the laboratory's ability to perform the test methods. The test method review ranges from observing tests to having laboratory staff describe the test procedures. The assessor notes on the On-Site Assessment - Test Method Review Summary (p. F-4) the depth into which each part of the test method was reviewed.

The test method review is directly connected to the critical elements. Note that the column headings of the Test Method Review Summary are essentially the same as the headings of the critical elements.

(4) An assessor performs the following activities during a typical on-site assessment:

(i) Conducts an entry briefing with the laboratory manager to explain the purpose of the on-site visit and to discuss the schedule for the day(s). At the discretion

of the laboratory manager, other staff may attend the briefing.

(ii) Reviews laboratory quality manual (if not previously requested and supplied) and records. At least one laboratory staff members must be available to answer questions; however, the assessor may wish to review the documents alone.

(iii) Physically examines equipment and facilities and observes the demonstration of selected procedures by appropriate personnel assigned to conduct the tests, and interviews those personnel. The demonstrations must include sample test material(s), preparation of devices, establishment of test conditions and the setup/use of major equipment. The assessor may provide the proficiency test sample and request a specific demonstration.

(iv) Completes an On-Site Assessment Report, which contains the minimum requirements prescribed in NIST Handbook 150, Sec. 285.22(b)(2), as well as copies of the completed checklists. At the exit briefing, a discussion of the assessment is carried out. The first page of the report (Appendix G) is signed by the assessor and the laboratory's Authorized Representative to acknowledge the discussion but does not necessarily indicate agreement; challenge(s) may be made through NVLAP. All observations made by the NVLAP assessor are held in the strictest confidence.

(b) Proficiency Testing

(1) NIST Handbook 150 defines (Sec. 285.5) and describes (Sec. 285.22(4)) how proficiency testing is included in the accreditation process. Proficiency testing is conducted twice a year. Laboratories renewing accreditation must have satisfactorily participated in all required proficiency testing during their previous accreditation period. EEL test methods that require proficiency testing are identified by an asterisk in the Test Method Selection List (Appendix D).

(2) NVLAP conducts the proficiency testing for the EEL program through a proficiency testing contractor.

(3) Twice a year each laboratory is sent, (or is instructed to obtain), selected test samples, data sheets, and instructions for test specimen handling, preparation, conditioning, mounting, and testing. Proficiency testing may consist of several parts in order that the operation of a laboratory might be evaluated. Also, portions of the testing process may be "highlighted," e.g., measurement and instrumentation, hardware, and data analysis. Generally, it is required that the test procedure be conducted in accordance with the applicable test method; however, at times special conditions are specified to assure uniformity in procedures and test conditions among participants. Those may include the number of repeated measurements, special conditions of temperature and humidity, and other test parameters. ***The work must not be contracted out to another laboratory.*** Completed test results and data sheets must be returned to NVLAP, or the designated return address, by the date specified on the data sheets. Failure to return the data sheets by the deadline may result in penalties which may include suspension of accreditation.

(4) On occasion, the on-site assessor hand carries proficiency test samples to the laboratory. These proficiency test samples, like all others received by the laboratory, are to be listed or entered into the normal registration/identification system for control and data records. In these cases, the samples may be returned to the on-site assessor rather than stored at the laboratory. Additionally, in some cases, the laboratory may be instructed to reship the samples to the proficiency testing contractor, or to a designation specified by NVLAP or the proficiency testing contractor.

(5) After completion of a given proficiency test round, samples that are not returned to the on-site assessor or proficiency testing contractor become the property of the laboratory for use at its discretion. Experience has shown that these proficiency test samples are often useful to the laboratory as training artifacts, or as calibration-check samples. ***However, in no case shall these proficiency test samples be considered as***

calibration standards and be used as substitutes for primary calibration standards that are traceable to national (i.e., NIST) or international standards laboratories.

(6) Proficiency test data are analyzed using statistical procedures to determine parameters such as distributions and outliers. The results of the proficiency testing are reported to the participants in appropriate documents and reports. The identity and performance of individual laboratories remain confidential. Test data from proficiency testing and other quality system actions performed in the laboratory (or with other laboratories) must be summarized and used in monitoring its performance.

The results of proficiency testing are made available to on-site assessors for use during laboratory assessment visits. If problems are indicated by proficiency testing, they are discussed with appropriate laboratory personnel responsible for developing and implementing plans for resolving the problems. After notification, the laboratory must resolve deficiencies identified by proficiency testing in a timely manner similar to the process for on-site assessment deficiency resolution. Failures may result in revocation or suspension of accreditation.

Sec. 285.23 Granting and renewing accreditation

Laboratories granted NVLAP accreditation are provided with two documents: a Certificate of Accreditation and a Scope of Accreditation. Samples of these accreditation documents for the EEL program are shown in Appendix A. Note that the certificate states that the criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987).

Sec. 285.33 Criteria for accreditation

(c) Quality system, audit and review

(1) Under its quality system, the laboratory shall develop and implement procedures covering all of the technical requirements in this handbook.

(2) The quality manual must contain or make reference to the location of:

(i) procedures for receipt, identification, and tracking of test samples;

(ii) procedures by which the laboratory describes the lamp and luminaire test samples and the criteria for their acceptance or rejection;

(iii) detailed descriptions of the procedures and equipment that the laboratory uses in conducting photometric measurements of the different lamp types and luminaires for which it seeks accreditation;

NOTE: The standardized photometric test procedures have been developed to be generally applicable to a variety of lamps and luminaires that differ by factors such as size, shape, spectral characteristics, and intensity. As a consequence, a laboratory needs to incorporate specific details into the design, construction, and operation of the photometric test equipment that it uses to conduct photometric tests of particular lamps and luminaires. The detailed descriptions of the test equipment and instrumentation must include the operation and calibration procedures. The uncertainty of measurements must be discussed.

(iv) the laboratory's participation in proficiency testing, a summary of the results, and a description of any corrective actions taken because of the results; and

(v) the personnel training required for conducting the test procedures.

(3) The Illuminating Engineering Society (IES) LM-58 (NVLAP Code 22/C01), *Spectroradiometric Measurements*, prescribes in general terms the instrument and measurement requirements, calibration procedures, and physical standards for conducting the measurements, but is not specific as to instrument, object, or material. Laboratories seeking accreditation for colorimetric measurements of light sources conducted in accordance with IES LM-58 must include in the quality manual, or make

reference to, detailed descriptions of the procedure(s) it uses to conduct the tests.

(4) The type and size of test specimens (both lamps and luminaires) which fall within the scope of a given test method may be broad. In some cases, a laboratory's photometric equipment may be limited so that the laboratory cannot measure the properties of the complete range of specimens. Therefore, the laboratory's quality manual shall list the range of specimens it can test for each method for which accreditation is sought.

(5) During the on-site assessment, the NVLAP assessor reviews the laboratory's own detailed procedures to perform tests of lamps and luminaires according to the standardized test procedures for which it seeks accreditation, the range of specimens it can test, and the descriptions of the maintenance and calibration of its specific equipment. Such descriptions may be prepared in a form convenient to the particular needs of the laboratory, but all the elements required by NVLAP procedures must be covered. A central single reference must be available to indicate where this documentation and/or the parts thereof is located throughout the facility, if it is not included in the manual. The documentation must be readily accessible.

(6) The most recent publication of the standards for the test methods for which the laboratory is accredited shall be available as references, and are to be followed in conducting the given test procedures. The test methods selected by the laboratory are from the IES and ANSI documents listed in Sec. 285.4 *References* and the Test Method Selection List (Appendix D).

Laboratories seeking accreditation to IES LM-58 on Spectroradiometric Measurements shall have available a copy of Commission Internationale de l'Eclairage (CIE) Publication No. 13.2, *Method of Measuring and Specifying Color Rendering of Light Sources*. This publication is a reference document for the calculation of the color rendering index (CRI) of the test specimens from the results of the spectroradiometric measurements. The Energy Policy Act of 1992 has set minimum CRI requirements for certain fluorescent lamps; consequently, the EEL program requires laboratories participating in proficiency testing of fluorescent lamps using IES LM-58 to report the CRI.

Laboratories seeking accreditation to IES LM-58 shall also have available a copy of IES LM-16, *Practical Guide to Colorimetry of Light Sources*, which provides background information and commentary on colorimetry procedures and techniques.

(d) Personnel

(1) The laboratory shall maintain records on each staff member, including a résumé of qualifications; laboratory testing procedures to which the person is assigned; and the results of periodic testing performance reviews, which may include intra-operator tests and between-laboratory tests.

NOTE: For the purpose of on-site assessments, a separate personnel folder of information specific to applicable NVLAP requirements may be provided instead of the complete and general folder maintained for other organization functions and purposes.

(2) The laboratory shall have a description of its training program for ensuring that staff are able to perform tests properly.

(3) The laboratory shall ensure that each new staff member is trained for the testing duties assigned and that staff members are retrained when they are assigned new responsibilities or when test methods are updated.

(4) The laboratory shall evaluate the competency of each staff member for each test method the staff member is authorized to conduct.

(i) An evaluation and observation of performance shall be conducted annually by the immediate supervisor, or a designee appointed by the laboratory director, and must be adequately documented.

(ii) A record of the annual evaluation of each staff member must be dated and signed by the supervisor

and the employee, and retained in the personnel file.

(5) The laboratory shall implement, as a minimum, the following training requirements for each staff member assigned to conduct the test methods for which the laboratory seeks accreditation:

(i) general requirements of the test methods;

(ii) specimen preparation and/or mounting techniques;

(iii) lamp seasoning and stabilization procedures;

(iv) photometric measurement techniques for the lamps assigned;

(v) voltage and current measurement;

(vi) oscilloscope measurements;

(vii) ballast circuit connection and measurement;

(viii) photometric calibration techniques;

(ix) thermocouple mounting and calibration; and

(x) colorimetric measurement techniques.

(6) Reference documents, texts, and current scientific and industry periodicals shall be made available to all technical staff to keep their knowledge up to date.

(f) Equipment and reference materials

The equipment used for conducting the tests in the EEL program shall be maintained and calibrated (or verified) in accordance with the manufacturer's recommendation, as specified in the test method, or as specified below, whichever results in shorter time periods between calibrations:

Apparatus/Instrumentation	*Frequency*
black panel thermometer unit	annually
automatic data logging and readout	annually
ammeters, ohmmeters	annually
voltmeters, wattmeters	annually
potentiometers	annually
thermocouple and related instrumentation	annually
oscilloscopes	annually
environmental control apparatus	annually
photometers	per test method
spectroradiometers	per test method
colorimeters	per test method
reference ballasts	per test method

(g) Measurement traceability and calibration

(1) The laboratory's calibrations may be performed by properly trained staff using calibrated standards, or through contract(s) with a competent external calibration service. All calibrations and characterizations must be done against reference standards that are traceable to national standards maintained by NIST or by a foreign national standards authority that issues reference or calibration materials. It is the responsibility of the laboratory seeking accreditation to determine that, where appropriate, calibration services use reference standards traceable to NIST or a foreign national standards authority. A NVLAP-accredited calibration-service laboratory fulfills the foregoing traceability requirement.

(2) The reference standards used and the environmental conditions at the time of calibration shall be documented for all calibrations. Calibration records and evidence of the traceability of the reference standards used must be made available for inspection during the on-site visit.

(3) In addition to the information specified in NIST Handbook 150, Sec. 285.33(f)(4), testing equipment or verification records shall include the following:

(i) notation of all equipment variables requiring verification;

(ii) the range of verification;

(iii) the resolution of the instrument and its allowable error;

(iv) identity of the laboratory individual or external service responsible for calibration; and

(v) source of reference standard and traceability.

(h) Calibration and test methods

(1) Laboratories must use the test procedures described in the standards given in the Test Method Selection List (Appendix D).

(2) Departures are permissible only for conditions based upon technical reasons and must be acceptable to the client. Departures from those procedures must be identified in detail in test reports. Data must be available to show that departures are equivalent to or improve the accuracy and/or precision of the measurement without compromising a given test. On-site assessors may only recommend acceptance of the departures to NVLAP but are not authorized to grant approval to the laboratories.

(j) Records

(1) Records may be kept in hard copy or computer form (with an adequate back-up system) and shall be readily accessible and secure. Entries in laboratory notebooks shall be dated and signed or initialed. Computer-based records must contain entries of pertinent staff/date information for data as required in the quality manual and means to preserve integrity for maintenance of records, without later modifications, as an established safeguard. Records will be reviewed during the on-site assessment by selected sampling.

(2) The records to be maintained include:

(i) acceptance/rejection of lamps and luminaires submitted for test;

(ii) comprehensive logs for tracking samples and test activities;

(iii) original data collected by the laboratory;

(iv) calibration and verification data;

(v) data and results of quality control;

(vi) equipment and maintenance records; and

(vii) test reports.

(3) Test records, sufficient to reconstruct test reports, shall be kept for a period of three years following the completion of testing, unless a longer period is required by the client, regulation, or the laboratory's own procedures.

(k) Certificates and reports

(1) All test reports must contain sufficient information for the exact test conditions to be reproduced at a later time if a retest is necessary. Reports intended for use only by the vendor may conform to vendor/laboratory contract obligations, but must be in accord with NVLAP requirements.

(2) In many cases, raw data collected by computer are collated, reduced, analyzed, or otherwise treated for direct incorporation in the test report. Such treatment involving electronic transmission of the data and writing of the test report is generally performed at the laboratory or at an immediately close area at the facility where the laboratory is located. However, at times, the report may be written at an adjunct facility that is located some distance from the testing laboratory.

The distinction between locations where the report is written has little significance regarding the actual transmission of the raw data and development of the test report. In either case, the laboratory must have in place, with appropriate written descriptions in the quality manual, procedures and documentation for assuring the quality and validity of the data transmission, and their incorporation in the test report. If organizations use several departments for discrete functions of testing, data collection, data processing, and test reporting, it is necessary that lines of responsibility with distinct supervisory positions be defined and that no conflict exist. The assessor will review the procedures and documentation during the on-site assessment, and also assure that all NVLAP procedures

regarding the writing and storage of reports are followed.

Special situations may exist when distant separated facilities are involved for test data generation at one locale and data processing and test report preparation at another locale. Then, the technical assessor cannot meet at the time of the laboratory inspection with the individual responsible for the data analysis and the writing of the report when they occur at a distant adjunct location. Depending upon the on-site laboratory evaluations of the written descriptions and other documentation for assuring the validity of the data transmission and subsequent report writing, an inspection visit to the adjunct facility may be required. When warranted, the assessor will visit the adjunct facility at additional cost to the laboratory before accreditation is granted.

When a test report is written at an adjunct facility removed from the laboratory, the report must include the names and addresses of both those responsible for conducting the laboratory tests and for writing the test report. Copies of typical reports written at an adjunct facility must be available at the laboratory at the time of the on-site inspection for review by the inspector for compliance with NVLAP procedures.

APPENDIX A

SAMPLE ACCREDITATION DOCUMENTS

United States Department of Commerce
National Institute of Standards and Technology

NVLAP®

ISO/IEC GUIDE 25:1990
ISO/IEC GUIDE 58:1993
ISO 9002:1994

Certificate of Accreditation

DEPARTMENT OF COMMERCE ★ UNITED STATES OF AMERICA ★

LABORATORY, INC.
ANYTOWN, USA

is recognized under the National Voluntary Laboratory Accreditation Program for satisfactory compliance with criteria established in Title 15, Part 285 Code of Federal Regulations. These criteria encompass the requirements of ISO/IEC Guide 25 and the relevant requirements of ISO 9002 (ANSI/ASQC Q92-1987) as suppliers of calibration or test results. Accreditation is awarded for specific services, listed on the Scope of Accreditation for:

ENERGY EFFICIENT LIGHTING PRODUCTS

January 1, 19xx
Effective until

Albert D. Tholen
For the National Institute of Standards and Technology

NVLAP LAB CODE: 0000

National Institute of Standards and Technology — NVLAP® — National Voluntary Laboratory Accreditation Program

ISO/IEC GUIDE 25:1990
ISO/IEC GUIDE 58:1993
ISO 9002:1994

Scope of Accreditation

ENERGY EFFICIENT LIGHTING PRODUCTS **NVLAP LAB CODE: 0000**

LABORATORY, INC.
1 Main Street
Anytown, USA 00000
John Doe Phone: 301-555-1212

NVLAP Code	*Designation*	*Short Title*
ELECTRICAL		
22/E01	IES LM-9	Fluorescent Lamps-Electrical Measurements
22/E02	IES LM-45	Incandescent Lamps-Electrical Measurements
22/E03	IES LM-51	High Intensity Discharge (HID) Lamps-Electrical Measurements
PHOTOMETRIC		
22/P01a	IES LM-9	Fluorescent Lamps-Photometric - Total Flux Measurements
22/P02b	IES LM-20	Reflector Type Lamps-Photometric - Photometric-Intensity Measurements
22/P05a	IES LM-66	Single-Ended Compact Fluorescent Lamps - Photometric-Total Flux Measurements
LIFE TESTS		
22/L01	IES LM-40	Fluorescent Lamps-Life Test Performance
22/L02	IES LM-47	High Intensity Discharge Lamps-Life Test Performance
22/L03	IES LM-49	Incandescent Filament Lamps-Life Test Performance

January 1, 19xx

Effective until

For the National Institute of Standards and Technology

APPENDIX B

GENERAL OPERATIONS CHECKLIST

GENERAL OPERATIONS CHECKLIST

Instructions to the Assessor: This checklist addresses general accreditation criteria prescribed in applicable sections of NIST Handbook 150, *NVLAP Procedures and General Requirements*.

This checklist follows and is numbered to correspond to the *NVLAP Procedures and General Requirements*, Subsection 285.33. The numbers in square brackets identify related checklist items. A small black triangle appears in the left-hand margin of selected lines of text throughout this checklist; the marked text applies only to the Calibration Laboratory Accreditation Program (LAP).

Place an "X" beside each checklist item which represents a deficiency. Place a "C" beside each item on which you are commenting for other reasons. Record the item number and your written deficiency explanations and/or comments in this list or on the attached comment sheets. Place a check beside all other items you observed or verified at the laboratory.

SEC. 285.33 CRITERIA FOR ACCREDITATION

(b) ***Organization and management***

(1) The laboratory shall be:

_____ (i) legally identifiable;

Legal name of laboratory ownership: _____

(ii) organized and shall operate in such a way that its permanent, temporary and mobile facilities meet the NVLAP requirements [see also (b)(2)(i), (c)(2)(ii)];

_____ (iii) properly identified on the NVLAP Application.

(2) The laboratory shall:

_____ (i) have managerial staff with the authority and resources needed to discharge their duties [see also (b)(1)(ii), (c)(2)(ii)];

_____ (ii) have policies to ensure that its personnel are free from any commercial, financial and other pressures which might adversely affect the quality of their work;

_____ (iii) be organized in such a way that confidence in its independence of judgment and integrity is maintained at all times;

_____ (iv) specify and document the responsibility, authority and interrelation of all personnel who manage, perform or verify work affecting the quality of calibrations and tests;

_____ (v) provide supervision by persons familiar with the calibration or test methods and procedures, the objective of the calibration or test, and the assessment of the results. The ratio of supervisory to non-supervisory personnel shall be such as to ensure adequate supervision;

_____ (vi) have a technical manager (however named) who has overall responsibility for the technical operations;

Name of person: _____

_____ (vii) have a quality manager (however named) who has responsibility for the quality system and its implementation. The quality manager shall have direct access to the highest level of management at which decisions are taken on laboratory policy or resources, and to the technical manager. In some laboratories, the quality manager may also be the technical manager or deputy technical manager;

Name of person: _____

_____ (viii) nominate deputy(ies) in case of absence of the technical or quality manager;

Name(s): _____

_____ (ix) have documented policy and procedures to ensure the protection of clients' confidential information and proprietary rights [see also (c)(2)(xviii)];

_____ (x) where appropriate, participate in interlaboratory comparisons and proficiency testing programs [see also (c)(2)(xiv), (c)(6)(ii), (g)(3)];

_____ (xi) have documented policy and procedures to ensure that its clients are served with impartiality and integrity.

(c) ***Quality system, audit and review***

(1) The laboratory shall:

_____ (i) have an established and maintained quality system appropriate to the type, range and volume of calibration and testing activities it undertakes;

_____ (ii) have the elements of the quality system documented;

_____ (iii) ensure that the quality documentation is available for use by the laboratory personnel;

_____ (iv) define and document its policies and objectives for, and its commitment to, good laboratory practice and quality of calibration or testing services;

_____ (v) have the laboratory management which ensures that these policies and objectives are documented in a quality manual and communicated to, understood, and implemented by all laboratory personnel concerned;

_____ (vi) ensure that the quality manual is maintained current under the responsibility of the quality manager [see also (c)(2)(iv)].

Date of quality manual: _____

Date of latest update: _____

(2) The quality manual, and related quality documentation, shall state the laboratory's policies and operational procedures established in order to meet the NVLAP requirements. The quality manual and related quality documentation shall contain:

_____ (i) a quality policy statement, including objectives and commitments, by top management;

_____ (ii) the organization and management structure of the laboratory, its place in any parent organization and relevant organizational charts;

_____ (iii) the relations between management, technical operations, support services and the quality system;

_____ (iv) procedures for control and maintenance of documentation [see also (c)(1)(vi), (j)(1)];

_____ (v) job descriptions of key staff and reference to the job descriptions of other staff;

_____ (vi) identification of the laboratory's approved signatories (list here or in the comments section): _____

_____

_____ (vii) the laboratory's procedures for achieving traceability of measurements;

_____ (viii) the laboratory's scope of calibrations and/or tests;

_____ (ix) written procedures for ensuring that the laboratory reviews all new work to ensure that it has the appropriate facilities and resources before commencing such work;

_____ (x) reference to the calibration, verification and/or test procedures used;

_____ (xi) procedures for handling calibration and test items;

_____ (xii) reference to the major equipment and reference measurement standards used;

_____ (xiii) reference to procedures for calibration, verification and maintenance of equipment;

_____ (xiv) reference to verification practices including interlaboratory comparisons, proficiency testing programs, use of reference materials and internal quality control schemes [see also (b)(2)(x), (c)(6)(ii), (g)(3)];

(xv) procedures to be followed for feedback and corrective action whenever:

_____ a) testing discrepancies are detected, or

_____ b) departures from documented policies and procedures occur;

_____ (xvi) the laboratory management policies for departures from documented policies and procedures or from standard specifications;

_____ (xvii) procedures for dealing with complaints [see also (n)];

_____ (xviii) procedures for protecting confidentiality and proprietary rights [see also (b)(2)(ix)];

_____ (xix) procedures for audit and review;

_____ (xx) a description of the laboratory's policy regarding the use of the NVLAP logo;

► _____ (xxi) a statement of the laboratory's policy for establishing and changing
► calibration intervals for equipment it controls; and

_____ (xxii) a statement of the laboratory's policy concerning the technique(s) to be used for determining measurement uncertainty and calibration/verification adequacy.

_____ (3) The laboratory shall arrange for audits of its activities at appropriate intervals to verify that its operations continue to comply with the requirements of the quality system. Such audits shall be carried out by trained and qualified staff who are, wherever possible, independent of the activity to be audited. Where the audit findings cast doubt on the correctness or validity of the laboratory's calibration or test results, the laboratory shall take immediate corrective action and shall immediately notify, in writing, any client whose work may have been affected.

The audits shall be objective and be conducted internally or on contract. The audits shall include both general criteria (documents, records and policies) and technical compliance (test methods and practices and calibration procedures).

_____ (4) The quality system adopted to satisfy the NVLAP requirements shall be reviewed at least once a year by the management to ensure its continuing suitability and effectiveness and to introduce any necessary changes or improvements.

_____ (5) All audit and review findings and any corrective actions that arise from them shall be documented. The person responsible for quality shall ensure that these actions are discharged within the agreed timescale.

(6) In addition to periodic audits the laboratory shall ensure the quality of results provided to clients by implementing checks. These checks shall be reviewed and shall include, as appropriate, but not be limited to:

_____ (i) internal quality control plans, such as control charts and other available statistical techniques;

NOTE: Measurement assurance techniques are acceptable means to control the measurement process and consistently produce the highest quality measurements.

_____ (ii) participation in proficiency testing or other interlaboratory comparisons [see also (b)(2)(x), (c)(2)(xiv), (g)(3)];

_____ (iii) regular use of certified reference materials and/or in-house quality control using secondary reference materials;

_____ (iv) replicate testings using the same or different methods;

_____ (v) retesting of retained items;

_____ (vi) correlation of results for different characteristics of an item.

(d) ***Personnel*** [see also (c)(2)(v)]

_____ (1) The testing laboratory shall have sufficient personnel, having the necessary education, training, technical knowledge and experience for their assigned functions.

_____ (2) The testing laboratory shall ensure that the training of its personnel is kept up-to-date.

_____ (3) Records on the relevant qualifications, training, skills and experience of the technical personnel shall be maintained by the laboratory.

(e) ***Accommodation (facilities) and environment*** [see also (i)(3)]

_____ (1) Laboratory accommodation, calibration and test areas, energy sources, lighting, heating and ventilation shall be such as to facilitate proper performance of calibrations or tests.

NOTE: Laboratory design will be, to the maximum extent practical, in accordance with the guidelines found in the NCSL Recommended Practice #7, *Laboratory Design*, July 25, 1993.

_____ (2) The environment in which these activities are undertaken shall not invalidate the results or adversely affect the required accuracy of measurement. Particular care shall be taken when such activities are undertaken at sites other than the permanent laboratory premises.

NOTE: It is expected that environments which do not meet generally accepted norms, such as those found in NCSL Recommended Practice #7, yet which exhibit the stability required to apply necessary correction factors, will be specified by the laboratory for the purpose of assessment of compliance with its own procedures to achieve its stated uncertainties.

_____ (3) The laboratory shall provide facilities for the effective monitoring, control and recording of environmental conditions as appropriate. Due attention shall be paid, for example, to biological sterility, dust, electromagnetic interference, humidity, voltage, temperature, and sound and vibration levels, as appropriate to the calibrations or tests concerned.

_____ (4) There shall be effective separation between neighboring areas when the activities therein are incompatible.

_____ (5) Access to and use of all areas affecting the quality of these activities shall be defined and controlled.

_____ (6) Adequate measures shall be taken to ensure good housekeeping in the laboratory.

NOTE: While it is the laboratory's responsibility to comply with relevant health and safety requirements, this is outside the scope of this assessment.

(f) *Equipment and reference materials*

(1) The laboratory shall:

_____ (i) be furnished with all items of equipment (including hardware, software, and reference materials) required for the correct performance of calibrations and tests;

_____ (ii) in those cases where the laboratory needs to use equipment outside its permanent control, including rented, leased and client-owned equipment, ensure that the relevant NVLAP requirements are met.

_____ (2) All equipment shall be properly maintained. Maintenance procedures shall be documented. Any item of the equipment which has been subjected to overloading or mishandling, or which gives suspect results, or has been shown by verification or otherwise to be defective, shall be taken out of service, clearly identified and wherever possible stored at a specified place until it has been repaired and shown by calibration, verification or test to perform satisfactorily. The laboratory shall examine the effect of this defect on previous calibrations or tests.

_____ (3) Each item of equipment including reference materials shall, when appropriate, be labelled, marked or otherwise identified to indicate its calibration status.

_____ (4) Records shall be maintained of each item of equipment and all reference materials significant to the calibrations or tests performed. The records shall include:

_____ (i) the name of the item of equipment, software or reference material;

_____ (ii) the manufacturer's name, type identification, and serial number or other unique identification;

_____ (iii) date received and date placed in service;

NOTE: For initial accreditation, the date received and the date placed in service are not considered mandatory requirements for inclusion in laboratory records, although this is encouraged as good laboratory practice.

_____ (iv) current location, where appropriate;

_____ (v) condition when received (e.g. new, used, reconditioned);

_____ (vi) copy of the manufacturer's instructions, where available;

_____ (vii) dates and results of calibrations and/or verifications and date of next calibration and/or verification;

_____ (viii) details of maintenance carried out to date and planned for the future;

_____ (ix) history of any damage, malfunction, modification or repair;

► _____ (x) measured value observed for each parameter found to be out of tolerance
► during calibration/verification.

(g) ***Measurement traceability and calibration***

_____ (1) All measuring and testing equipment having an effect on the accuracy or validity of calibrations or tests shall be calibrated and/or verified before being put into service. The laboratory shall have an established program for the calibration and verification of its measuring and test equipment. The program will ensure the recall or removal from service of any standard or equipment which has exceeded its calibration interval or is otherwise judged to be unreliable.

_____ (2) The overall program of calibration and/or verification and validation of equipment shall be designed and operated so as to ensure that, wherever applicable, measurements made by the laboratory are traceable to national standards of measurement where available. Calibration certificates shall, wherever applicable, indicate the traceability to national standards of measurement and shall provide the measurement results and associated uncertainty of measurement and/or a statement of compliance with an identified metrological specification.

NOTE: Traceability to national standards includes traceability to standards maintained or defined at national laboratories in foreign countries where applicable. In these cases, traceability is achieved via international standards. This includes intrinsic standards of measurement where available.

Where applicable, the methodology of the *Guide to the expression of uncertainty in measurement*: 1993, shall be used as the basis for expression of uncertainty of the measurement. NIST Technical Note 1297; January 1993, *Guidelines for Evaluating and Expressing the Uncertainty of NIST Measurement Results*, is a practical application document written around the *Guide to the expression of uncertainty in measurement*. Where detailed procedures are not used to quantify and combine uncertainties (i.e., use of test accuracy ratio concepts), the sources of uncertainty shall be tabulated and demonstrated to be acceptable for the measurement undertaken.

NOTE: A significant number of intrinsic standards, such as the Josephson Array Voltage Standard and the Iodine-Stabilized Helium-Neon Laser Length Standard, have been developed and are now being used by many national standards laboratories and some industrial laboratories. These standards are based on well-characterized laws of physics, fundamental constants of nature, or invariant properties of materials, and make ideal stable, precise, and accurate measurement standards if properly designed, characterized, operated, monitored and maintained. Where intrinsic standards are used, the laboratory should demonstrate by measurement assurance techniques, interlaboratory comparisons, or other suitable means, that its intrinsic standard measurement results are correlated with those of national or international standards.

_____ (3) Where traceability to national standards of measurement is not applicable, the laboratory shall provide satisfactory evidence of correlation of results, for example by participation in a suitable program of interlaboratory comparisons or proficiency testing [see also (b)(2)(x), (c)(2)(xiv), (c)(6)(ii)].

NOTE: Traceability requirements may also be satisfied by:

(i) internationally accepted standards in the field concerned;

(ii) suitable reference materials;

(iii) ratio or reciprocity measurements; or

(iv) mutual consent standards which are clearly specified and mutually agreed upon by all parties concerned.

_____ (4) Reference standards of measurement held by the laboratory shall be used for calibration only and for no other purpose, unless it can be demonstrated that their performance as reference standards has not been invalidated.

_____ (5) Reference standards of measurement shall be calibrated by a body that can provide traceability to a national standard of measurement. There shall be a program of calibration and verification for reference standards.

_____ (6) Where relevant, reference standards and measuring and testing equipment shall be subjected to in-service checks between calibrations and verifications.

_____ (7) Reference materials shall, where possible, be traceable to national or international standards of measurement, or to national or international standard reference materials.

(h) ***Calibration and test methods***

_____ (1) The laboratory shall have documented instructions on the use and operation of all relevant equipment, on the handling and preparation of items and for calibration and/or testing, where the absence of such instructions could jeopardize the calibrations or tests. All instructions, standards, manuals and reference data relevant to the work of the laboratory shall be maintained up-to-date and be readily available to the staff.

_____ (2) The laboratory shall use appropriate methods and procedures for all calibrations and tests and related activities within its responsibility (including sampling, handling, transport and storage, preparation of items, estimation of uncertainty of measurement and analysis of calibration and/or test data). They shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations or tests concerned.

NOTES:

(i) Calibration procedures shall contain the required range and tolerance or uncertainty of each item or unit parameter being calibrated or verified. In addition, the procedures shall contain the generic description of the measurement standards and equipment needed with the required parameter, range, tolerances or uncertainties, and specifications for performing the measurement of the calibration or verification, and/or representative types (manufacturer, model, option) that are capable of meeting the generic description for the measurement standards. The procedures shall be consistent with the accuracy required, and with any standard specifications relevant to the calibrations/verifications concerned.

(ii) The laboratory shall ensure that the calibration uncertainties are sufficiently small so that the adequacy of the measurement is not affected. Well-defined and documented measurement assurance techniques or uncertainty analyses may be used to verify the adequacy of a measurement process. If such techniques are not used, then the collective uncertainty of the measurement standards shall not exceed 25% of the acceptable tolerance (e.g., manufacturer's specification) for each characteristic of the measuring and test equipment being calibrated or verified.

_____ (3) Where methods are not specified, the laboratory shall, wherever possible, select methods that have been published in international or national standards, those published by reputable technical organizations or in relevant scientific texts or journals.

_____ (4) Where it is necessary to employ methods that have not been established as standard, these shall be subject to agreement with the client, be fully documented and validated, and be available to the client and other recipients of the relevant reports [see also (k)(2)(x)].

_____ (5) Where sampling is carried out as part of the test method, the laboratory shall use documented procedures and appropriate statistical techniques to select samples [see also (k)(2)(ix)].

_____ (6) Calculations and data transfers shall be subject to appropriate checks.

(7) Where computers or automated equipment are used for the capture, processing, manipulation, recording, reporting, storage or retrieval of calibration or test data, the laboratory shall have written procedures which ensure that:

_____ (i) the NVLAP requirements are complied with;

_____ (ii) computer software, computers or automated equipment is documented and adequate for use;

_____ (iii) procedures are established and implemented for protecting the integrity of data; such procedures shall include, but not be limited to, integrity of data entry or capture, data storage, data transmission and data processing;

_____ (iv) computer and automated equipment is maintained to ensure proper functioning and provided with the environmental and operating conditions necessary to maintain the integrity of calibration and test data [see also (f)(1)];

_____ (v) it establishes and implements appropriate procedures for the maintenance of security of data including the prevention of unauthorized access to, and the unauthorized amendment of, computer records.

_____ (8) Documented procedures shall exist for the purchase, reception and storage of consumable materials used for the technical operations of the laboratory [see also (m)(2)].

(i) ***Handling of calibration and test items***

_____ (1) The laboratory shall have a documented system for uniquely identifying the items to be calibrated or tested, to ensure that there can be no confusion regarding the identity of such items at any time [see also (k)(2)(v)].

_____ (2) Upon receipt, the condition of the calibration or test item, including any abnormalities or departures from standard condition as prescribed in the relevant calibration or test method, shall be recorded. Where there is any doubt as to the item's suitability for calibration or test, where the item does not conform to the description provided, or where the calibration or test required is not fully specified, the laboratory shall consult the client for further instruction before proceeding. The laboratory shall establish whether the item has received all necessary preparation, or whether the client requires preparation to be undertaken or arranged by the laboratory.

_____ (3) The laboratory shall have documented procedures and appropriate facilities to avoid deterioration or damage to the calibration or test item, during storage, handling, preparation, and calibration or test; any relevant instructions provided with the item shall be followed. Where items have to be stored or conditioned under specific environmental conditions, these conditions shall be maintained, monitored and recorded where necessary. Where a calibration or test item or portion of an item is to be held secure (for example, for reasons of record, safety or value, or to enable check calibrations or tests to be performed later), the laboratory shall have storage and security arrangements that protect the condition and integrity of the secured items or portions concerned [see also (e)].

_____ (4) The laboratory shall have documented procedures for the receipt, retention or safe disposal of calibration or test items, including all provisions necessary to protect the integrity of the laboratory.

_____ (5) Tamper-resistant seals shall be affixed to operator-accessible controls or adjustments on measurement standards or measuring and test equipment which, if moved, will invalidate the calibration. The laboratory's calibration system shall provide instructions for the use of such seals and for the disposition of equipment with damaged or broken seals.

NOTE: Tamper-resistant seals are sometimes affixed to equipment to prevent unauthorized access to areas where adjustments or critical components are located.

(j) ***Records***

_____ (1) The laboratory shall maintain a record system to suit its particular circumstances and comply with any applicable regulations. It shall retain on record all original observations, calculations and derived data, calibration records and a copy of the calibration certificate, test certificate or test report for an appropriate period. The records for each calibration and test shall contain sufficient information to permit their repetition. The records shall include the identity of personnel involved in sampling, preparation, calibration or testing [see also (c)(2)(iv)].

▸ **EXCEPTION:** The retention of all original observations, calculations, and
▸ derived data in the calibration record system is not a mandatory requirement
▸ for calibration laboratories, although it is encouraged as good laboratory
▸ practice.

_____ (2) All records (including those listed in (f)(4) pertaining to calibration and test equipment), certificates and reports shall be safely stored, held secure and in confidence to the client [see also (b)(2)(ix), (c)(2)(xviii)].

NOTE: The period of retention shall be specified in the quality manual.

Record retention time specified: _____

(k) *Certificates and reports*

_____ (1) The results of each calibration, test, or series of calibrations or tests carried out by the laboratory shall be reported accurately, clearly, unambiguously and objectively, in accordance with any instructions in the calibration or test methods. The results should normally be reported in a calibration certificate, test report or test certificate and should include all the information necessary for the interpretation of the calibration or test results and all information required by the method used [see also (k)(4)(i)].

NOTE: It is recognized that the results of each calibration do not always result in the production of a calibration certificate or report. Whenever a certificate or report is produced, the above requirements shall be met.

(2) Each certificate or report shall include at least the following information:

_____ (i) a title, e.g., "Calibration Certificate," "Test Report" or "Test Certificate";

_____ (ii) name and address of laboratory, and location where the calibration or test was carried out if different from the address of the laboratory;

_____ (iii) unique identification of the certificate or report (such as serial number) and of each page, and the total number of pages;

_____ (iv) name and address of client, where appropriate;

_____ (v) description and unambiguous identification of the item calibrated or tested [see also (i)(1)];

_____ (vi) characterization and condition of the calibration or test item;

_____ (vii) date of receipt of calibration or test item and date(s) of performance of calibration or test, where appropriate;

EXCEPTION: Although it is encouraged as good laboratory practice, the requirement for inclusion of the date received is not mandatory for calibration laboratories.

_____ (viii) identification of the calibration or test method used, or unambiguous description of any non-standard method used;

_____ (ix) reference to sampling procedure, where relevant [see also (h)(5)];

_____ (x) any deviations from, additions to or exclusions from the calibration or test method, and any other information relevant to a specific calibration or test, such as environmental conditions [see also (c)(2)(xv), (h)(4)];

_____ (xi) measurements, examinations and derived results, supported by tables, graphs, sketches and photographs as appropriate, and any failures identified;

_____ (xii) a statement of the estimated uncertainty of the calibration or test result, where relevant;

_____ (xiii) a signature and title, or an equivalent identification of the person(s) accepting responsibility for the content of the certificate or report (however produced), and date of issue [see also (c)(2)(vi)];

_____ (xiv) where relevant, a statement to the effect that the results relate only to the items calibrated or tested;

_____ (xv) a statement that the certificate or report shall not be reproduced except in full, without the written approval of the laboratory;

_____ (xvi) a statement that the report must not be used by the client to claim product endorsement by NVLAP or any agency of the U.S. Government;

_____ (xvii) the signature of an approved signatory for all test and calibration reports endorsed with the NVLAP logo;

▸ _____ (xviii) special limitations of use; and

▸ _____ (xix) traceability statement.

_____ (3) Where the certificate or report contains results of calibrations or tests performed by subcontractors, these results shall be clearly identified [see also (l)].

_____ (4) Particular care and attention shall be paid to the arrangement of the certificate or report, especially with regard to presentation of the calibration or test data and ease of assimilation by the reader. The format shall be carefully and specifically designed for each type of calibration or test carried out, but the headings shall be standardized as far as possible [see also (k)(1)].

_____ (5) Material amendments to a calibration certificate, test report or test certificate after issue shall be made only in the form of a further document, or data transfer including the statement "Supplement to Calibration Certificate (or Test Report or Test Certificate), serial number ... (or as otherwise identified)," or equivalent form of wording. Such amendments shall meet all the relevant requirements of item (j).

_____ (6) The laboratory shall notify clients promptly, in writing, of any event such as the identification of defective measuring or test equipment that casts doubt on the validity of results given in any calibration certificate, test report, or test certificate or amendment to a report or certificate.

NOTE: Such notification shall quantify the magnitude of error created in the calibration results. The laboratory shall notify customers promptly, in writing, of any customer's measuring and test equipment found significantly out of tolerance during the calibration/verification process. Measurement data shall be reported so that appropriate action can be taken.

_____ (7) The laboratory shall ensure that, where clients require transmission of calibration or test results by telephone, telex, facsimile or other electronic or electromagnetic means, staff will follow documented procedures that ensure that the NVLAP requirements are met and that confidentiality is preserved.

_____ (8) Whenever a laboratory accredited by NVLAP issues a calibration or test report which contains data covered by the accreditation and also data not covered by the accreditation, it must clearly identify in its records, and in the report to the client, specifically which calibration or test method(s), or portion of a calibration or test method(s), was not covered by the accreditation. The laboratory must also inform the client, before the fact, when calibrations or tests requested are not covered by the accreditation.

NVLAP policy regarding calibration and test reports issued by an accredited laboratory, which reference the laboratory's accredited status, requires that any calibration or test report containing data from calibrations or tests which are not covered by the accreditation include:

_____ (i) a statement at the beginning of the report prominently indicating, "This report contains data which are not covered by the NVLAP accreditation"; and

_____ (ii) a clear indication of which data are not covered by the accreditation.

The laboratory must not misrepresent its accreditation. When a client requires or requests accredited services and any of the requested services are not covered by the accreditation, the client must be so advised.

(l) ***Subcontracting of calibration or testing*** [see also (k)(3)]

_____ (1) Where a laboratory subcontracts any part of the calibration or testing, this work shall be placed with a laboratory complying with these requirements. The laboratory shall ensure and be able to demonstrate that its subcontractor is competent to perform the activities in question and complies with the same criteria of competence as the laboratory in respect of the work being subcontracted. The laboratory shall advise the client in writing of its intention to subcontract any portion of the testing to another party.

_____ (2) The laboratory shall record and retain details of its investigation of the competence and compliance of its subcontractors and maintain a register of all subcontracting.

_____ (3) A NVLAP-accredited laboratory intending to subcontract testing or calibration work that will be performed and reported as meeting NVLAP procedures and criteria must:

_____ (i) have in its quality manual a subcontracting policy compatible with the NVLAP policy, with a description of the procedures for administering and implementing those actions to demonstrate the conformance and consistency of the subcontracted laboratory to perform according to NVLAP procedures;

_____ (ii) place the subcontracted work with a laboratory that maintains accreditation established by NVLAP shown by a current NVLAP Lab Code, or provide and maintain current records that demonstrate that the subcontracted laboratory is competent to perform the test(s) or calibration(s) and that it operates in a manner consistent with and in conformance to NVLAP criteria for accreditation;

_____ (iii) clearly identify in its records, and in the report to the client, exactly which data were obtained by the NVLAP-accredited laboratory and which data were obtained by the subcontractor, NVLAP-accredited or not;

_____ (iv) inform its client, before the fact, that it intends to subcontract for completion of all or a portion of the client's work; and

_____ (v) include at the beginning of the report the name, address, and contact person of the subcontracted laboratory(ies), and one of the following statements, as appropriate:

if NVLAP-accredited

"This report contains data which were produced by a subcontracted laboratory **ACCREDITED (NVLAP LAB CODE)** for the calibration or test methods performed"

if not NVLAP-accredited

"This report contains data which were produced by a subcontracted laboratory **NOT ACCREDITED** for the calibration or test methods performed."

The requirements of this section do not supersede any regulation, law, contract specification, or other related conditions which require NVLAP accreditation.

(m) ***Outside support services and supplies***

_____ (1) Where the laboratory procures outside services and supplies in support of calibrations or tests, the laboratory shall use only those outside support services and supplies that are of adequate quality to sustain confidence in the laboratory's calibrations or tests.

_____ (2) Where no independent assurance of the quality of outside support services or supplies is available, the laboratory shall have procedures to ensure that purchased equipment, materials and services comply with specified requirements. The laboratory should, wherever possible, ensure that purchased equipment and consumable materials are not used until they have been inspected, calibrated or otherwise verified as complying with any standard specifications relevant to the calibrations or tests concerned [see also (h)(8)].

_____ (3) The laboratory shall maintain records of all suppliers from whom it obtains support services or supplies required for calibrations or tests.

(n) ***Complaints*** [see also (c)(2)(xvii)]

_____ (1) The laboratory shall have documented policy and procedures for the resolution of complaints received from clients or other parties about the laboratory's activities. A record shall be maintained of all complaints and of the actions taken by the laboratory.

_____ (2) Where a complaint, or any other circumstance, raises doubt concerning the laboratory's compliance with the laboratory's policies or procedures, or with the NVLAP requirements or otherwise concerning the quality of the laboratory's calibrations or tests, the laboratory shall ensure that those areas of activity and responsibility involved are promptly audited in accordance with item (c)(3).

(o) *Measuring and test equipment (M & TE)*

NOTE: This section applies to the control of measuring and test equipment (M & TE) used to assure that supplies and services comply with prescribed customer requirements. It is based in large part on the requirements found in government audit standards such as MIL-STD 45662A, and is found in Part II of the ANSI/NCSL Z540-1-1994 (Draft) standard.

(1) General requirements for M & TE

_____ (i) The supplier shall establish and document a system to control the calibration/verification of M & TE.

_____ (ii) M & TE used to determine compliance with customer technical specifications shall be calibrated or verified in accordance with sections 285.33(b) through (n).

_____ (iii) The supplier shall have a program to recall for calibration or verification, or remove from service, M & TE that has exceeded its calibration interval, has broken calibration seals, or is suspected to be malfunctioning because of mishandling, misuse, or unusual results.

_____ (iv) All operations performed by the supplier in compliance with these requirements shall be subject to customer verification at unscheduled intervals.

_____ (v) The supplier shall carry out, or arrange to have carried out, periodic quality auditing of the calibration and verification system in order to ensure its continuing effective implementation and compliance with these requirements.

- Based on the results of the audits and any other relevant factors, such as customer feedback, the supplier shall review and modify the system as necessary.

- Plans and procedures for the audits shall be documented. The conduct of the audit and any subsequent corrective action shall also be documented.

(2) Detailed requirements for M & TE

_____ (i) Calibration system description: The supplier shall provide and maintain a written description of the calibration/verification system covering M & TE and measurement standards. The description shall be sufficient to satisfy each requirement of section 285.33(o) and any deviations shall be submitted with supporting documentation to the customer for approval.

_____ (ii) Adequacy of measurement standards: Measurement standards used by the supplier for calibrating M & TE and other measurement standards shall comply with the requirements of items (f)(1), (g)(1), and (h)(2).

_____ (iii) Environmental conditions: M & TE shall be used in an environment controlled to the extent necessary to ensure valid results. Due consideration shall be given to temperature, humidity, lighting, vibration, dust control, cleanliness, electromagnetic interference and any other factors affecting the results of measurements. Where pertinent, these factors shall be monitored and recorded and, when appropriate, correcting compensations shall be applied to measurement results.

_____ (iv) Intervals of calibration and verification: M & TE requiring calibration shall be calibrated or verified at periodic intervals established and maintained to assure acceptable reliability, where reliability is defined as the probability that M & TE will remain in-tolerance throughout the interval. Intervals shall be established for all M & TE requiring calibration unless the equipment is regularly monitored through the use of check standards in a documented measurement assurance process. Check standards must closely represent the item parameters normally tested in the process and the check standard must be verified periodically. Where intervals are used to ensure reliability, the interval setting system must be systematically applied and shall have stated reliability goals and a method of verifying that the goals are being attained. Intervals may be based on usage or time since last calibration or verification. All exemptions from periodic calibration or verification shall be documented. The recall system may provide for the temporary extension of the calibration due date for limited periods of time under specified conditions that do not unreasonably impair the satisfaction of the customer's requirements.

_____ (v) Calibration procedures: Procedures used to calibrate/verify the supplier's M & TE shall comply with the requirements of items (h)(1) and (h)(2).

_____ (vi) Out-of-tolerance conditions: If any M & TE is found to be significantly out of tolerance during the calibration/verification process, the supplier's system shall provide for notification to the user and to the supplier's quality element, if appropriate, of the out-of-tolerance condition with the associated measurement data so that appropriate action can be taken.

_____ (vii) Adequacy of calibration system: The supplier shall establish and maintain documented procedures to evaluate the adequacy of the calibration system and to ensure compliance with these requirements.

_____ (viii) Calibration sources: M & TE requiring calibration shall be calibrated or verified by laboratories that comply with sections 285.33(b) through (n).

_____ (ix) Records: These requirements shall be supported by records documenting that established schedules and procedures are followed to maintain the adequacy of all M & TE. The records for M & TE requiring calibration shall include an individual record of calibration or verification, or other means of control, providing a description or identification of the item, calibration interval, date calibrated, identification of the calibration source, calibration results (data and/or condition status) and calibration action taken (adjusted, repaired, new value assigned, derated, etc.).

_____ (x) Calibration status: M & TE shall be labeled to indicate calibration or verification status. The label shall identify specific date calibrated (day, month, year, Julian date, or equivalent) and the specific calibration due date or usage equivalent. Items not calibrated to their full capability or which have other limitations of use, shall be labeled or otherwise identified as to the limitations. When it is impractical to apply a label directly to an item, the label may be affixed to the instrument container or some other suitable means may be used to reflect calibration status. Tamper-resistant seals are affixed to operator accessible controls or adjustments which if moved will invalidate the calibration. The quality system shall provide instructions for the disposition of equipment with broken tamper-resistant seals.

_____ (xi) Control of subcontractor calibration: The supplier is responsible for assuring that the subcontractor's calibration system conforms to section 285.33 (l) to the degree necessary to assure compliance with contractual requirements. NVLAP accreditation of the subcontractor's laboratory can serve as the basis for compliance with this requirement.

_____ (xii) Storage and handling: M & TE shall be handled, stored, and transported in a manner which shall not adversely affect the calibration or condition of the equipment.

NVLAP LAB CODE: [ ]

GENERAL OPERATIONS CHECKLIST - COMMENTS AND DEFICIENCIES

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*

NVLAP LAB CODE: [ ]

GENERAL OPERATIONS CHECKLIST - COMMENTS AND DEFICIENCIES

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*

APPENDIX C

SPECIFIC OPERATIONS CHECKLIST

NVLAP LAB CODE: ____

SPECIFIC OPERATIONS CHECKLIST

ENERGY EFFICIENT LIGHTING PRODUCTS TESTING

Instructions to the Assessor: The checklist addresses specific accreditation criteria prescribed in Section 5, *Technical Requirements* of the Energy Efficient Lighting Products (EEL) Testing Program Handbook. Included also are instructions and comments sheets used for observing actual demonstrations of the performance of selected test methods. These criteria **do not** supersede the *Criteria for Accreditation*, based on Section 285.33 of the NVLAP Procedures, which are addressed in the GENERAL OPERATIONS CHECKLIST (Appendix F).

Place an "X" beside any of the following items which represent a deficiency. Place a "C" beside each item on which you are commenting for other reasons. Record the item number and your deficiency explanation and/or comments on the appropriate comment sheet(s). Place a check beside all other items you observed or verified at the laboratory.

1 *Quality System*

_____ 1.1 The quality manual provides detailed procedures, including descriptions of equipment, that the laboratory follows in performing photometric and colorimetric tests.

_____ 1.2 The quality manual lists the range of test specimens that a laboratory can test for each test method for which accreditation is sought.

_____ 1.3 The quality manual describes practices for maintenance and calibration of the equipment used in conducting the tests on energy efficient lighting products. Specific calibration requirements for the EEL program are:

- in accordance with the manufacturer's recommendation;
- the test method; or
- as specified below:

Apparatus/Instrumentation	*Calibration or Verification Frequency*
automatic data logging and readout	annually
ammeters, ohmmeters, voltmeters, wattmeters	annually
potentiometer	annually
thermocouple and related instrumentation	annually
oscilloscope	annually
environmental control apparatus	annually
photometers	per test method
colorimeters	per test method
reference ballasts	per test method

2 *Personnel*

The personnel competency program for Energy Efficient Lighting Products Testing includes the applicable portions of the following, as a minimum:

_____ 2.1 General requirements of the test method

_____ 2.2 Specimen preparation and/or mounting techniques

_____ 2.3 Techniques for measuring ambient thermal conditions

_____ 2.4 Lamp seasoning and stabilization procedures

_____ 2.5 Procedures for transporting lamps between warm-up racks and measurement apparatus

_____ 2.6 Photometric measurement procedures

_____ 2.7 Voltage, current, and electrical power measurements

_____ 2.8 Oscilloscope measurements

_____ 2.9 Ballast circuit connection and measurement

_____ 2.10 Photometric calibration techniques

_____ 2.11 Thermocouple mounting and calibration

_____ 2.12 Colorimetric measurement techniques

_____ 2.13 Goniophotometric measurement techniques.

3 *Calibration and Test Methods*

_____ 3.1 Proper sample preparation and maintenance, in appropriate conditioned state, before testing.

_____ 3.2 Sample and test specimen identification for correlation with related record.

_____ 3.3 Test data forms (as required by the reference standard or developed in-house) are properly completed.

_____ 3.4 Participant staff for the test maintains a dated log book or record.

_____ 3.5 Test equipment, devices, and instruments meet the requirements (and meet calibration conditions).

_____	3.6	Electrical power is conditioned and regulated within standard specifications.
_____	3.7	The test method(s) are performed correctly, and are appropriate for the given lamp or luminaire specimens.
_____	3.8	Test(s) are conducted within the specified temperature, humidity, and/or air flow conditions.
_____	3.9	Lamps tested in the specified orientation, if any.
_____	3.10	Test lamps have been properly seasoned.
_____	3.11	Measurement circuitry is appropriate for the test method.
_____	3.12	Calibration of photometric standards is verified.
_____	3.13	Measurements are reported only after lamps have stabilized.
_____	3.14	For photometric measurements, test reports adequately describe the procedures and equipment.
_____	3.15	For life performance tests, laboratory procedures for monitoring and recording lamp failure times are appropriate to the test methods.
_____	3.16	Test reports are complete and accurate for the given lamp or luminaire specimens.

NVLAP LAB CODE: _____

EEL SPECIFIC OPERATIONS CHECKLIST - COMMENTS AND DEFICIENCIES

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number from the checklist. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item No.	*Comments and/or Deficiencies*
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
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_____	_____
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_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____
_____	_____

APPENDIX D

TEST METHOD SELECTION LIST

NVLAP LAB CODE: _____

ENERGY EFFICIENT LIGHTING PRODUCTS
TEST METHOD SELECTION LIST

Instructions: Check each test method for which you are requesting accreditation.

An asterisk beside the NVLAP Test Method Code indicates that proficiency testing is required. Notification will be given for the required proficiency testing by NVLAP and/or a NVLAP contractor.

NVLAP Test Method Code	*Test Method Designation*	*Short Title*
LAMPS		
Electrical Measurements		
_____ 22/E01*	IES LM-9[1]	Fluorescent Lamps-Electrical Measurements
_____ 22/E02*	IES LM-45[1]	Incandescent Lamps-Electrical Measurements
_____ 22/E03[2]	IES LM-51[1]	High Intensity Discharge (HID) Lamps - Electrical Measurements
_____ 22/E04*	IES LM-66[1]	Single-Ended Compact Fluorescent Lamps - Electrical Measurements
_____ 22/E05	ANSI-C78.375	Fluorescent Lamps - Electrical Measurements
_____ 22/E06	ANSI-C78.386	Mercury Lamps - Measurement of Characteristics
_____ 22/E07	ANSI-C78.387	Metal-Halide Lamps - Measurement of Characteristics
_____ 22/E08	ANSI-C78.388	High Pressure Sodium Lamps - Measurement of Characteristics

[1]Includes all sections of the IES document applicable to electrical measurements.

[2]The Illuminating Engineering Society (IES) has temporarily withdrawn for revision LM-20, "IES Approved Method for Photometric Measuring and Reporting Tests on Reflector Type Lamps" (NVLAP Test Method Codes 22/P02a and b), and LM-51, "IES Approved Method for the Electrical and Photometric Measurements of High Intensity Discharge Lamps" (NVLAP Test Method Codes 22/E03, and 22/P04a and b). NVLAP will offer initial accreditation for these two test methods when the Illuminating Engineering Society completes the revision and reissues Test Methods LM-20 and LM-51.

Photometric Measurements

Note: Accreditation for Photometric Tests requires corresponding accreditation for Electrical Test Methods.

_____	22/P01a*	IES LM-9[3]	Fluorescent Lamps-Photometric-Total Flux Measurements
_____	22/P01b*	IES LM-9[3]	Fluorescent Lamps-Photometric-Intensity Measurements
_____	22/P02a[4]	IES LM-20	Reflector Type Lamps-Photometric-Total Flux Measurements
_____	22/P02b[4]	IES LM-20	Reflector Type Lamps Photometric-Intensity Measurements
_____	22/P03a*	IES LM-45[3]	Incandescent Lamps-Photometric-Total Flux Measurements
_____	22/P03b*	IES LM-45[3]	Incandescent Lamps Photometric-Intensity Measurements
_____	22/P04a[4]	IES LM-51[3]	High-Intensity Discharge Lamps-Photometric-Total Flux Measurements
_____	22/P04b[4]	IES LM-51	High-Intensity Discharge Lamps-Photometric-Intensity Measurements
_____	22/P05a*	IES LM-66[3]	Single-Ended Compact Fluorescent Lamps-Photometric-Total Flux Measurements
_____	22/P05b*	IES LM-66[3]	Single-Ended Compact Fluorescent Lamps-Photometric-Intensity Measurements

Color Measurements

_____	22/C01*	IES LM-58	Spectroradiometric Measurements

[3]Includes all sections of the IES document applicable to the photometric measurements.

[4]The illuminating Engineering Society (IES) has temporarily withdrawn for revision LM-20, "IES Approved Method for Photometric Measuring and Reporting Tests on Reflector Type Lamps" (NVLAP Test Method Codes 22/P02a and b), and LM-51, "IES Approved Method for the Electrical and Photometric Measurements of High Intensity Discharge Lamps" (NVLAP Test Method Codes 22/E03, and 22/E03, and 22/P04a and b). NVLAP will offer initial accreditation for these two test methods when the Illuminating Engineering Society completes the revision and reissues Test Methods LM-20 and LM-51.

Life Tests

_____	22/L01	IES LM-40	Fluorescent Lamps-Life Test Performance
_____	22/L02	IES LM-47	High Intensity Discharge Lamps-Life Test Performance
_____	22/L03	IES LM-49	Incandescent Filament Lamps-Life Test Performance
_____	22/L04	IES LM-65	Single-Ended Compact Fluorescent Lamps-Life Test Performance

LUMINAIRES (LIGHTING FIXTURES)

_____	22/F01	IES LM-10	Photometric Testing of Outdoor Fluorescent Luminaires
_____	22/F02	IES LM-31	Photometric Testing of Roadway Luminaires
_____	22/F03	IES LM-35	Photometric Testing of Floodlights Using Incandescent Filament or Discharge Lamps
_____	22/F04	IES LM-41*	Photometric Testing of Indoor Fluorescent Luminaires
_____	22/F05	IES LM-46*	Photometric Testing of Indoor Luminaires Using HID Lamps

_____ Total number of test methods selected for Energy Efficient Lighting Products (Enter total on Line 5b of the Program Fee Calculation Worksheet.)

NVLAP LAB CODE: _____

ENERGY EFFICIENT LIGHTING PRODUCTS
PROFICIENCY TEST INFORMATION - PHOTOMETRIC TESTS

The following information is required about your photometric equipment in order to provide proper artifacts for Proficiency Testing. Complete only those parts pertaining to tests for which you are seeking accreditation.

NVLAP Test Method Code	*Test Method Designation*	*Limitation*
22/P01a & P01b	IES LM-9	Longest lamp (ft.)? _____
22/P03a & P03b	IES LM-45	Min. lumens? _____
		Max. lumens? _____
22/P05a & P05b	IES LM-66	Min. lumens? _____
		Max. lumens? _____
22/F04	IES LM-41	Smallest luminaire (ft.)?
		L _____; W _____; H _____
		Largest luminaire (ft.)?
		L _____; W _____; H _____
22/F05	IES LM-46	Smallest luminaire (ft.)?
		L _____; W _____; H _____
		Largest luminaire (ft.)?
		L _____; W _____; H _____

APPENDIX E

CRITICAL ELEMENTS

CRITICAL ELEMENTS

DESCRIPTION: "Critical elements" are summary statements of key provisions from standard test methods. These summaries are provided to the Technical Experts for use during on-site assessments, as part of their operation manual. This appendix shows the format of a critical element summary, but the critical elements for the EEL Program are not included in this handbook.

PURPOSE: Critical elements assist the assessors in uniformly and objectively conducting their evaluations. The critical elements provide guidance for a common basis to be applied by individual assessors in conducting on-site evaluations. They are *not* intended to be replacements for the written test procedures issued by standards-development organizations.

FORMAT OUTLINE: Typically, the critical element summary includes the headings listed below. The explanatory comments given below indicate the type of information summarized under each heading.

PROGRAM TITLE: The title of the specific NVLAP program; in the present case, the EEL Program.

NVLAP TEST METHOD CODE: The code for each test method given on the Test Method Selection List for the specific NVLAP program.

TEST METHOD DESIGNATION: An alphanumeric designation assigned to the test method by the organization that issued the standard; in the case of the EEL Program, either ANSI or IES.

SHORT TITLE: The title of the test method as given on the NVLAP Test Method Selection List.

ENVIRONMENTAL/SAMPLE AND CONDITIONING REQUIREMENTS: A summary of conditioning or other treatment to which the test specimen is subjected before the test is conducted.

TEST EQUIPMENT AND APPARATUS: A listing of the major equipment and apparatus that the laboratory needs to have available to conduct the test.

CALIBRATION(S): A summary of the calibration requirements delineated in the test method.

TESTING PROCEDURES: A summary of the main steps of the test method.

STANDARD TEST REPORT REQUIREMENTS: A listing of the items that the method requires the test operator to include in the test report.

SPECIAL CONSIDERATIONS: A listing of those aspects of the test method to which the NVLAP technical assessor must pay special attention during the on-site assessment.

APPENDIX F

ON-SITE ASSESSMENT - TEST METHOD REVIEW

NVLAP LAB CODE: [ ]

NATIONAL VOLUNTARY LABORATORY ACCREDITATION PROGRAM

ON-SITE ASSESSMENT - TEST METHOD REVIEW

Instructions to the Assessor:

During the on-site visit you will be required to assess the laboratory's ability to conduct the specific test methods for which it has applied for accreditation. In some cases this will involve many test methods. You may not have sufficient time to perform an in-depth assessment of each method.

Use the attached sheets to indicate which test methods you assessed at the laboratory, and the extent of your assessment. Indicate whether you performed an in-depth review, including a full review of laboratory activities. These include sample control and preparation, procedure review, observation of actual testing, environmental control check, equipment review, calibration checks, record-keeping practices and report forms; or, that you observed selected items to determine that the laboratory demonstrated the ability to conduct the test.

The specific requirements for each test method are detailed in the CRITICAL ELEMENTS, the HANDBOOK, and/or the TEST METHOD. Any items required under "special considerations" will be described either in the CRITICAL ELEMENTS, special instructions below, or in other correspondence.

Fill out the ON-SITE ASSESSMENT - TEST METHOD REVIEW SUMMARY by writing in the test method designation. Indicate on the summary the DEPTH of the assessment for each test method you reviewed, using one of the symbols shown below:

OT - (Observed Test)
EA - (Examined Apparatus)
W/TT - (Walked/Talked Through)
LDP - (Listened to Description of Procedures)

All ***deficiencies*** must be accompanied by a comment.

Use the ON-SITE ASSESSMENT - TEST METHOD REVIEW COMMENTS AND DEFICIENCIES sheets to write comments on what you observed. Preface each comment with the test method designation to which the comment applies. Please be liberal with your comments so that we have a good written record of your observations; the more information we have, the better the accreditation decision we can make.

Special Instruction:

NVLAP LAB CODE:

National Voluntary Laboratory Accreditation Program (NVLAP)

ON-SITE ASSESSMENT - TEST METHOD REVIEW SUMMARY

Test Method (number, name or designation)	Depth of Assessment	Environmental/ Test Sample Conditioning	Test Equipment and Apparatus	Calibration	Test Procedures	Test Reports	Special Considerations

NVLAP LAB CODE: ____

ON-SITE ASSESSMENT - TEST METHOD REVIEW COMMENTS AND DEFICIENCIES

Instructions to the Assessor: Use this sheet to document comments and deficiencies. For each, identify the appropriate item number. Identify comments with a "C" and deficiencies with an "X." If additional space is needed, make copies of this page (or use additional blank sheets).

Item Number	*Comments and/or Deficiencies as Noted on the On-Site Assessment - Test Method Review Summary*

APPENDIX G

ON-SITE ASSESSMENT REPORT COVER SHEET

NVLAP LAB CODE: [ ]

National Institute of Standards and Technology
National Voluntary Laboratory Accreditation Program
(NVLAP)

ON-SITE ASSESSMENT REPORT

Laboratory Name_____

Program_____ On-Site Assessment Dates_____

Date Report Reviewed
with Laboratory_____ Assessor's Signature_____

Instructions for the Laboratory:

Respond in writing within 30 days of the date of this report, addressing all deficiencies noted by the assessor. All deficiencies must be satisfactorily resolved before accreditation may be granted. **Each deficiency must be referenced, in your response, by item number as it is listed in the Assessment Report checklists.**

The On-Site Assessment Report conveys the opinion of the assessor as a single representative of NVLAP. The final evaluation of your laboratory, for the purpose of recommending approval or denial of accreditation, will be conducted by NIST technical experts who will review this report, the written information submitted by you, and results of any required proficiency testing. You must respond to this report by identifying the actions you have taken to correct the deficiencies identified. Respond in detail so that an accurate evaluation can be completed. Failure to respond may delay an accreditation decision.

Send your response to: Chief, Laboratory Accreditation Program
National Institute of Standards and Technology
Building 411/Room A162
Gaithersburg, MD 20899

Signed Statement:

The assessor has discussed the contents of this report with members of the laboratory management who agree to respond in writing to NIST, regarding resolution or correction of any deficiencies noted, within 30 days of the date of this report.

_____ _____
Signature of Authorized Representative or designee Printed Name

NIST Technical Publications

Periodical

Journal of Research of the National Institute of Standards and Technology—Reports NIST research and development in those disciplines of the physical and engineering sciences in which the Institute is active. These include physics, chemistry, engineering, mathematics, and computer sciences. Papers cover a broad range of subjects, with major emphasis on measurement methodology and the basic technology underlying standardization. Also included from time to time are survey articles on topics closely related to the Institute's technical and scientific programs. Issued six times a year.

Nonperiodicals

Monographs—Major contributions to the technical literature on various subjects related to the Institute's scientific and technical activities.

Handbooks—Recommended codes of engineering and industrial practice (including safety codes) developed in cooperation with interested industries, professional organizations, and regulatory bodies.

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